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Research Article

THE LENGTH WEIGHT RELATIONSHIP AND CONDITION FACTOR OF THE THINLIP MULLET *LIZA RAMADA* AND THE FLATHEAD GREY MULLET *MUGILCEPHALUS* (MUGILIDAE) FISHES FROM AIN EL-GHZALA LAGOON, EASTERN LIBYA

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ABSTRACT

A random sample of 90 fish of two Mugilidae species (*Liza ramada*, and *Mugilcephalus*) was taken from Ain El-Ghazala lagoon, Eastern Libya during September 2013 – August 2014. The length-weight relationship, the condition factor and the sex ratio were conducted for the two species.The length-weight relationship was $W=_{0.016}L^{2.847}$ for *L. ramada*and and $W= _{0.014}L^{2.892}$for *M. Cephalus.* Both species exhibited negative isometric growth. *L. ramada* condition factor was high during summer (1.115196) and low during winter (0.999256), while *M. cephalus* condition factor was high in winter (1.129042) and low in autumn (0.986667).

INTRODUCTION

The relation between the length of fish and its weight has been used since 1930. It was first described by the cubic parabolarelation (Richer, 1975). But it was later replaced by the cubic parabola relation (general parabola), because it gives better results (Gulland, 1985). The values of a and b differ between species, through the year and through the spawning season (Ahemed, 1987). The relation between length (L) and weight (W) of fish is very important for estimating growth rates, age structures, and stock conditions; comparing life histories of fish species between regions; and assessing the condition of fish and other components of fish population dynamics (Bagenal and Tesch, 1978). Condition factor or the 'fatness' (k) is used to assess the well-being of the population with assumption that the growth of fish in ideal conditions maintains an equilibrium between length and weight (Hile, 1936). The Mugilidae family fish, referred to as mullets or grey mullets, are ray-finned fish inhabiting coastal and brackish waters of all tropical and temperate regions worldwide.

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The Mugilidae family includes 17 genera and 72 valid species, mostly classified in the genera Mugil and Liza, which have 18 and 24 species, respectively (Thomson, 1966; Nelson, 2006). Nine of these species were found in the eastern basin of the Mediterranean sea (Golani, *et al*. 2006). The objective of the present study was to estimate length-weight relationship and condition factor of two commercially important species: *Liza ramada* and*Mugilcephalus*, fromAin El-Ghazala lagoon, Eastern Libya.

MATERIALS AND METHODS

The Study area

Ain El-Ghzala lagoon lies along the eastern most stretch of the Libya coastline on the Mediterranean sea (32º 10` 26" N- 23º 18` 37" E), which is characterized mainly by a rocky shoreline and a border coast line plain with intermingled sandy beaches and tiny inlets. According to Reynolds *et al*., (1994) Ain El-Ghzala lagoon is a roughly thumb shaped indentation of the Gulf of Bomba that covers an area of some 180 ha. The lagoon is shallow with an estimated average depth of 2 meters and maximum depth of 4.2 meters. It is fed by fresh water springs from various points. Ain El-Ghzala lagoon is reported as a well preserved environment with a variety of diversified assemblages and natural monuments which are unique in the Mediterranean sea and associated with an exceptional biological wealth (Pergent *et al*., 2006).

Sampling

A total of 90 *Liza ramada*, and *Mugilcephalus* fish was randomly taken from Ain El-Ghazala lagoon, Eastern Libya during September 2013 – August 2014. The length-weight relationship for the two fishes was established following Gulland (1985):

$W = a*L^{b}$

Where W is the body weight, L is the total length, "a" and "b" are constants. The condition factors, K, in Autumn, Winter, Spring and Summer were estimated for the two fishes as described by Ahemed (1987).

$K = (W/L^3)*100.$

Where W= total weight of fish, L= total length.

Statistical analysis

The general Linear Model was performed to analyzed the morphometric data using Statistical Package for Social Sciences (SPSS) program version 20.0 (2012). The model was applied to the separated dada of each species. Differences between means were tested using Duncan's Multiple Range Test (DMRT)

$Y_{ijk} = \mu + S_i + R_j + E_{ijk}$

Where:

Y_{ijk} = the ijkth observation of the trait in question, μ = the overall mean.
S_i = the random effect of the ith sex, R_j = the jth season effect, E_{ijk}= residual error

RESULTS

Table (1) shows the results of some of the parameters studied for the *L. ramada*. Season had a significant effect on total length, standard length, and total weight. These parameters were highest in Autumn.The total length and total weight were lowest in spring and winter. The standard length was lowest in winter. The condition factorwas highest in summer and lowest in winter. All differences between the two sexes ($p>0.05$) were not significant. The condition factor was higher for females than for males. Within columns and for the same source of variation, means belong different superscripts differed significantly (p 0.05). Neither the season of collection nor the sex had significant influences on the length and weight performance of the *M. cephalus* (Table 2). The value of the condition factor was high in winter season and low in autumn.It was also higher in males than in females. Values of exponent (b) of the Length-Weight relationship (Table 3, Figures 1 and 2) were almost similar in both species (2.847 and 1:1.25 for *L. Ramada* and *M. Cephalus*). They exhibited slight negative isometric growth. The sex ratios (male: female) were also similar for both fish. They were slightly in favour of females (1:1.5 and1:1.25).

Table 1. Means and Standard errors of some traits studied in Liza ramada

Source of variation	Total length M±S.E	Standard length M±S.E	Total weight M±S.E	Condition factor
Seasons effect				
Autumn	28.6 ± 0.3^{c}	22.9 ± 0.3^{b}	237.5 ± 9.9^{b}	1.015233
Winter	26.7 ± 0.4^{ab}	21.4 ± 0.4^{a}	190.2 ± 10.5^{a}	0.999256
Spring	27.0 ± 0.5^{b}	22.2 ± 0.5^{ab}	199.4 ± 9.4^{a}	1.013057
Summer	25.7 ± 0.5^{a}	21.5 ± 0.4^{a}	189.3 ± 8.5^{a}	1.115196
Sex effect				
Male	26.4 ± 0.4^{a}	21.7 ± 0.4^{a}	190.1 ± 8.3^{a}	1.033167
Female	27.8 ± 0.3^{a}	22.4 ± 0.2^{a}	220.4 ± 7.2^{a}	1.960955

Within columns and for the same source of variation, means belong different superscripts differed significantly (p 0.05)

Table 2. Means and Standard errors of some traits studied in Mugilcephalus.

Source of variation	Total length M±S.E	Standard length M±S.E	Total weight M±S.E	Condition factor
Seasons effect				
Autumn	30.0±0.8	23.7±0.7	266.4±22.5	0.986667
Winter	30.1±0.6	23.9±0.5	307.9±19.9	1.129042
Spring	29.5±0.2	23.8±0.3	257.3±6.7	1.002245
Summer	30.1±0.4	24.9±0.4	271.1±4.8	0.994
Sex effect				
Male	29.5±0.4	23.6±0.4	267.6±12.4	1.042366
Female	30.3±0.6	24.3±0.5	279.0±16.3	1.002943

Table 3. Length Weight relationship equation, values of a, b, and sex ratio of species studied

Species	Number of fish	Length-Weight Equation	a	b	Sex ratio
L.ramada	45	$W=0.016L^{2.847}$	0.016	2.847	1:1.5
M. cephalus	45	$W= 0.014L^{2.892}$	0.014	2.892	1:1.25
Total	90				

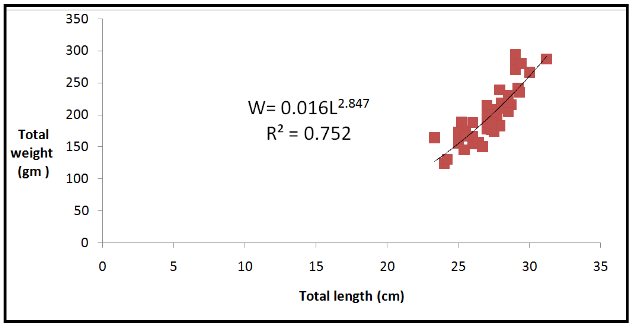

Figure 1. The Length Weight relationship of Liza ramada from Ain El -Ghzala eastern coast of Libya

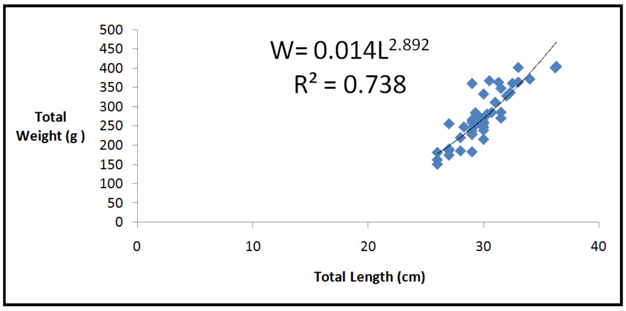

Figure 2. The Length weight relationship of Mugil cephalus from Ain El-Ghzala eastern coast of Libya

DISCUSSION

In the present study, the established length-weight relationships were found to be significant ($p < 0.001$). The values of b were 2.847 for*L.ramada*, and 2.892 for *M. cephalus*. *L. ramada* showed high mean total length in Autumn (28.6 cm) at mean total weight of 237.3 gm and lower mean total length (25.7cm) in Summer, with high condition factor (1.115196). While for *M. ceplalus* the high mean total length (30.1cm) was in winter and summer at mean total weight 307.9 gm and 271.1gm respectively, and high condition factor (1.129042) in winter. The differences between b values may be due to one or more factors: the season and the effect of area of origin, sex and the food availability (Moutopoulos and Stergiou, 2002; Elawad, 2009). Glamuzina, *et al*., 2007, studied the thin-lipped Mullet *Liza ramada*, in Neretva river, delta (eastern Adriatic, Croatian coast, the maximum length was estimated as 59.95 cm at corresponding weight of 2 kg, and the exponent b value as 3.18.Moutopoulos *et al*., 2011, investigated Length-Weight Relationships for 10 commercial fish species as a possible trophic state index of Coastal Lagoons in Greece. They mentioned that for *L.ramada* the b exponent ranged from 3.376 to 3.504.Cubedo, *et al*., 2005, found that for *M. cephalus*, from Mar Menor coastal lagoon of western Mediterranean sea b was 3.357. Rao and Babum 2013, stated that length of *M. cephalus* from the east coast of Andhar Pradesh in India ranged between 13.4cm to 30.5cm for females and 13.4cm to 37.0cm for males, and exponent b ranged between 2.16 to 2.81.Kasimoslu, *et al*., 2011, for *Liza ramada* from the Southern Aegean Sea, Turkey, indicated a condition cycle that was evident in both sexes, peaking in August (1.135 for males and 1.136 for females).Eyo and Ikechukwu, 2015. Mentioned that for *M. cephalus* from Cross River Estuary, Nigeria, the condition factor was highest in May (1.96 ± 0.04) followed by 1.88 ± 0.04 in June and 1.75 ± 0.05 in July.

The variation between all these studies reflects the differences in the sampling design, as the numbers of specimens and length ranges of the species were distinct among localities (Tesch, 1971; Sparre*et al*. 1989;stated that the differences in the length range covered for *L. ramada*and *M. cephalus*, should be considered when using parameters of weight-length relationships, as to some extent the smallest specimens may change the parameters (Moura and Gorda, 2000; Nelson, 1994; and Oliveira and Ferreira, 1997). In the present study ratio of males to femalesof *L. ramada* and *M. cephalus* landed from Ain El-Ghazal coast Eastern Libya was 1:1.5 and 1:1.25 in order,in favor of females. Similar results were reported by Glamuzina, *et al*., 2007, from the Neretva river Delta (Eastern Adriatic, Croatian coast. The sex ratio between male to female for *L. ramad* was 1:1. Rao and Babu, 2013, mentioned that the sex ratio of *M. cephalus* from the East coast of Andhara Pradesh, India, was 1:1.2 in favor females.

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